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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/648,245	08/27/2003	Chandra Mouli	M4065.0658/P658	3753

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EXAMINER	
BLUM, DAVID S	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 02/15/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/648,245	MOULI ET AL.	
	Examiner	Art Unit	
	David S. Blum	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-131* is/are pending in the application.

4a) Of the above claim(s) *1-48 and 78-131* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *49-77* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-131* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *9/12/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

This action is in response to the remarks filed 10/12/05.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 49-51, 54-56, 59-62, 65, 72-74, and 76-77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EU 0 360 595).

Matsumoto teaches all of the positive steps of claims 49-51, 54-56, 59-62, 72-74, and 76-77 as follows.

Matsumoto teaches all of the positive steps of claims 49-51, 54-56, 59-62, and 72-74, except for the thickness of the pinned layer.

Regarding claim 49, Matsumoto forms a gate (8 is gate electrode) over a substrate, a first doped layer (11) of a first conductivity type in the substrate and adjacent said gate to a thickness of 5000 angstroms (column 3 lines 43-44, 0.5 microns=5000 angstroms), and a second doped region (5) of a second conductivity below the first region.

Regarding the thickness of the pinned layer (first doped layer being formed to a thickness of about 100 Angstroms to about 5oo angstroms), this is considered to be one of design choice and optimization.

These ranges are considered to involve routine optimization while it has been held to be within the level of ordinary skill in the art. As noted in In re Aller (105 USPQ233), the selection of reaction parameters such as temperature and concentration would have been obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art. Such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

One skilled in the requisite art at the time of the invention would have used any ranges or exact figures suitable to the method in the process of forming a diode regarding dimensions using prior knowledge, experimentation, and observation with the apparatus used in order to optimize the process and produce the pinned photodiode structure desired to the parameters desired.

Regarding claim 50, the dopant concentration is between 5x10sup17 and 1x10sup19 atoms per cm3 (column 3 line 45).

Regarding claim 51, the dopant concentration is between 1x10sup18 and 5x10sup18 atoms per cm3 (column 3 line 45).

Regarding claim 49, when forming the first doped layer, an in-situ doped layer of said first conductivity is formed over a first area of the substrate ((column 6 lines 1-17, boron also dopes oxide layer 7 and electrode 8).

Regarding claim 55, the layer is annealed, thus ions are diffused (column 6 lines 11-15).

Regarding claim 56, the diffusing (annealing) takes place between 900-1100 degrees C. (column 6 line 13).

Regarding claim 59, an undoped oxide layer (7) is formed over a second area of the substrate.

Regarding claim 60, ions of the first conductivity are implanted into the undoped oxide layer to form a doped oxide layer (column 6 lines 5-10).

Regarding claim 61, the doped oxide layer is annealed, therefore some ions will diffuse into the first region to form the first doped layer (column 6 line 13).

Regarding claim 62, the doped oxide layer is annealed between 900-1100 degrees C. (column 6 line 13).

Regarding claim 65, Matsumoto teaches forming the first doped region in a (gas) source plasma (column 4 lines 5-6, damage from the plasma processing) and in a third area of said substrate (electrode, SiO2 and part 11).

Regarding claim 72, Matsumoto teaches nominally a concentration of 10sup17 (column 5 line 4).

Regarding claim 73, the first conductivity is a p-type (column 4 line 34) and the second conductivity is an n-type (column 4 line 35).

Regarding claim 74, the photodiode is a pnp photodiode (column 1 lines 15-45).

Regarding claim 76, the pixel sensor is part of a CMOS imager (written description describes a CMOS, thus a CMOS imager).

Regarding claim 77, the pixel sensor is part of a CCD imager (column 1 lines 5-7).

3. Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595).

Matsumoto teaches all of the positive steps of claims 52-53 as recited above in regard to claim 49, except for the thicknesses and dosages.

Regarding claim 52, Matsumoto does not teach a thickness of **about** 100-300 angstroms but teaches nominally 5000 angstroms (.05microns). The examiner considers this dimension to be one of optimization (see claim 49 above). This is considered a matter of optimization.

These ranges are considered to involve routine optimization while it has been held to be within the level of ordinary skill in the art. As noted in In re Aller (105 USPQ233), the selection of reaction parameters such as temperature and concentration would have been obvious:

> "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art. Such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
> In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

One skilled in the requisite art at the time of the invention would have used any ranges or exact figures suitable to the method in the process of forming a photodiode regarding

temperature, thicknesses, and concentrations using prior knowledge, experimentation, and observation with the apparatus used in order to optimize the process and produce the photodiode structure desired to the parameters desired.

Regarding claim 53, Matsumoto does not teach a thickness of **about** 250 angstroms but teaches nominally 5000 angstroms (.05microns). This is considered a value of optimization as in claims 49 and 52 above.

4. Claims 57-58 and 63-64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Kirkpatrick (US 4151008).

Matsumoto teaches all of the positive steps of claims 57-58 and 63-64 as recited above in regard to claim 56, except for the short durations of annealing.

Regarding claim 57, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding claim 57, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding the claimed temperature, Matsumoto teaches 900 degrees C. as also taught by the instant specification. The instant specification does not teach any criticality (see case law regarding criticality above) between the taught range and the present claimed range. Therefore, this is considered a matter of optimization.

Regarding claim 63, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short

period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding claim 64, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding the claimed temperature, Matsumoto teaches 900 degrees C. as also taught by the instant specification. The instant specification does not teach any criticality (see case law regarding criticality above) between the taught range and the present claimed range. Therefore, this is considered a matter of optimization.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by substituting a rapid thermal anneal as taught by Kirkpatrick to reduce device degradation (column 1 lines 41-46) and produce high temperatures in a limited area for a short period of time (column 5 lines 40-41).

5. Claims 66-67 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Todd (US006743738B2).

Matsumoto teaches all of the positive steps of claims 66-67 and 71 as recited above in regard to claim 65, except for particulars of forming the doped layer using B2H6 and helium.

Regarding claim 66, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B2H6 (column 1 line 61) and diluted by another gas (column 7 lines 35-36 and 48-49) in a plasma.

Regarding claim 67, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B2H6 (column 1 line 61) and diluted by another gas, the another gas being helium (column 7 lines 35-36 and 48-49) in a plasma.

Regarding claim 71, Todd teaches a gas plasma source conducted in a radio frequency (column 11 line 53) for about 2 minutes (claims 40, 34, and 24, about 2 minutes reads on about 1 minute, neither range having definite metes and bounds. This is considered optimization as recited above.).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by using a known boron ion dopant source and method rather than to expend research time and money to discover a novel source, when a known source is available.

6. Claim 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Todd (US006743738B2) and in further view of Fuse (US4861729).

Matsumoto and Todd teach all of the positive steps of claim 70 as recited above in regard to claim 65 except for doping in an electro cyclotron (ECR).

Todd teaches a gas plasma source conducted in a radio frequency (column 11 line 53) for about 2 minutes (claims 40, 34, and 24, about 2 minutes reads on about 1 minute, neither range having definite metes and bounds. This is considered optimization as recited above.). Matsumoto teaches forming the dopant-excited species in an electromagnetic energy and as an example radio frequency. Fuse teaches forming a plasma from decaborane using a radio frequency and an electronic field in electron resonance (ECR). Thus Matsumoto may be describing or suggesting ECR without naming it.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by using a known method such as ECR, rather than to expend research time and money to discover a novel method, when a known method is available.

7. Claims 68-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Todd (US006743738B2) and in further view of Tom (US005993766A).

Matsumoto and Todd teach all of the positive steps of claims 68-69 as recited above in regard to claim 65, except for particulars of forming the doped layer using B2H6 and helium.

Regarding claim 68, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B2H6 (column 1 line 61) and diluted by another gas (column 7 lines 35-36 and 48-49) in a plasma. Tom teaches implanting boron from a source gas of B2H6 (abstract), pentaborane, BF3, B2F4 (equivalent to BF2) (column 9 lines 31, 36, 57, column 10 lines 54, 5766-67, column 11 line 1) as sources of boron ions, thus teaching an art recognized equivalence. It is noted that the instant specification does not teach any criticality between boron sources. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or of any unexpected results arising there from. Where patentability

is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding claim 69, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B2H6 (column 1 line 61) and diluted by another gas, the another gas being helium (column 7 lines 35-36 and 48-49) in a plasma. Tom teaches implanting boron from a source gas of B2H6 (abstract), pentaborane, BF3, B2F4 (equivalent to BF2) (column 9 lines 31, 36, 57, column 10 lines 54, 5766-67, column 11 line 1) as sources of boron ions, thus teaching an art recognized equivalence. It is noted that the instant specification does not teach any criticality between boron sources.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by using a known boron ion dopant source and method rather than to expend research time and money to discover a novel source, when a known source is available and as taught by Tom to have an art recognized equivalence to other sources.

Response to Arguments

8. Applicant's arguments with respect to claims 49-51, 54-56, 59-62, 72-74 have been considered but are moot in view of the new ground(s) of rejection.

The applicant argues that the examiner erred in asserting that the disclosure contains no disclosure of the critical nature of the claimed dimensions and that in describing a pinned diode for maximized blue light absorption, an ultra thin layer is desired, thus this is not an optimized range. The examiner is persuaded that there is support for a ultra-thin layer of **about** 100-500 angstroms, and there is expressed criticality to that range. However, one skilled in the art would know that a thin layer is required for maximum blue light absorption and in that light, one would modify the thickness of the layer of Matsumoto for any desired light adsorption. Further, the claims do not limit the photo diode for maximum blue light absorption, thus the criticality of about 100-500 angstroms is not brought into the claims.

The applicant argues that the other cited prior art references do not solve the deficiencies of Matsumoto (layer thickness). As stated above, the examiner believes the thickness to be one of optimization.

The applicant also argues that there is insufficient motivation to combine references and that Matsumoto and Kirkpatrick as well as Todd teach different methods. The examiner disagrees. Sufficient motivation was provided for the combination/modification of references. Further, the secondary references were selected for specific parts of their related teachings, not as an identical device in entirety.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (571)-272-1687) and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

David S. Blum
February 13, 2006